

"BBN Job #41540"  
Bob Kahn  
August 10, 1994, Tape #4  
-- CARIBINER GROUP

QUESTION

BOB KAHN

Well, there are really two visions, you know, one is the communications vision, and the other one is the sort of interactive computing resource sharing vision.

(OFF MIKE)

QUESTION

BOB KAHN

There are ... there are really two visions.

(OFF MIKE)

QUESTION

BOB KAHN

Well, there are really two visions of ... of what we're talking about here. One is the communications vision. And the second is the

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vision of interactive computing, computer resources sharing, you know, the interactions that take place over that with people, and the like. Um, the early 1960's, um, Paul Baron(?), who was then at the Rand Corporation, wrote, uh, I guess with help from some of his colleagues, a series of memoranda of distributed communications that fundamentally described, in very general terms, the idea of breaking communications in what he called something like message addressed blocks, with messages on them. Somehow, magically routing them through a network. He worked with Keith Unker(?) for ... I believe at Rand Corporation, at the time. And that led to a lot of the developments that were later dubbed packet switching, a term which I believe Donald Davies at the National Physical Laboratory actually coined. Um, there were two people at ARPA who were principally, uh, um, involved in this

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activity too. One was J.C.R. Licklighter(?), a professor at M.I.T., who was a ... a good friend of mine. And he had a wonderful vision of man/machine interaction ... and, in fact, collaborated with Bob Taylor, who also, I think, shared many of those same views. They wrote a very fine paper on interactive, uh, uh, computing in the 1960's. Um, Bob, I believe, was head of the I.P.T. office, an office that I later headed, and so did Larry Roberts. Um, at the time, when the decision to go forward with the ARPANET was, uh, made. And I believe Larry Roberts came to join Bob in the office. Larry took on, as I understand it, the day to day responsibilities for running that. Bob will be a far better one to talk about the politics in the office at the time. But the two of them were just a marvelous representative for the community. Bob, in his global views, in his support of the activity. Larry, in picking up the project day to day, and

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actually running it. They're two of my heroes.

QUESTION

BOB KAHN

Well, Licklighter was, uh, um, a marvelously erudite fellow, um, who could always see the good side of ... of everything. He loved to discuss ideas, debate things, but ... more than anything else, he was just a visionary. He ... he could see the future. And, as far as he was concerned, the rest was just a matter of implementation to make it happen. He was a joy to be around. Generator of as many ideas per unit time as you could absorb, and just a delightful person to interact with.

QUESTION

BOB KAHN

No, I can't address that. I just don't know.

QUESTION

BOB KAHN

Okay.

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QUESTION

(OFF MIKE)

BOB KAHN

I'll just take that one off line. Let me cogitate that. I don't want to be cavalier with an answer to that one.

(OFF MIKE)

QUESTION

BOB KAHN

You can cut if you like. I just want to think about that one, because ...

QUESTION

BOB KAHN

That's not an easy question to answer.

QUESTION

BOB KAHN

When ... when the ARPANET was being developed, um, I think it's fair to say that there was no established theory or basis on which one could design real time systems. To a large

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extent, that's still true today. And I think that, uh, the ARPANET represents, in the ... in the history of the world, probably the longest running distributed computation that's ever been developed by anybody. And it's sort of been up in continuous operation since 1969, and, um, embodied in its current view, I suspect, through the INTERNET - if you're willing to allow the torch to have been passed - uh, but even during the period when the ARPANET itself was around, from the 1969 through 1990 period, it was just a marvel in real time distributed computation to move the packets through. So many of the issues that people have subsequently been dealing with were actually dealt with in an imp ... an implementation fashion back then. I believe the people who were involved, which was not only myself, but the whole crew at BBNN, and the people around the country, actually learned quite a bit about how to design distributed

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systems in a modular fashion. We learned the importance of specifying interfaces, we learned the importance of describing protocols. I think the whole idea of protocols came out of that original packet switching activity. And the idea of layered protocols was a major contribution, in its own right, to the building of modular systems. Um, there are many particular practical things we found out that had to do with how many machines people would like to connect, and what they might actually use the net for, and how hard some of the particular problems were. But in some ways, those were a lower level than the larger set of issues that I just described. The main lessons that we learned was that packet switching could work, and that people could, in fact, do interactive computing over networks, and that that was actually a viable technology base.

#### QUESTION

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(OFF MIKE)

QUESTION

BOB KAHN

One of the interesting things about the development of packet switching, in general, is how strongly it's now been embraced by the telecommunications industry. Not only for their long haul networks, but for their local area networks. And ... and yet, how ... um, how far in a technology this seemed when it was first developed back in the late Sixties and early Seventies. I mean, my ... my feeling was that AT&T would have been a natural to just embrace this technology from day one. But, for a variety of reasons, probably largely having to do with the fact that there was no market, or no perceived market, or no obvious market at the time, they chose not to directly get involved, but rather to sell circuits to the government, to be used in the ARPANET. About ten years later,



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they decided to try on their own to build such a system. But even the early days of the INTERNET growth in the commercial sector were done by the nontraditional telecommunications carriers. I think what's happened, as a result of all of that, all of the market development has now been done. And every one of the carriers - AT&T, MCI, Sprint, the Bell regionals - now recognize the value of packet switching technology. The ATM concept, which they're all embracing, is really an embodiment of some of the early work on packet switching for voice that was done by ARPA in the early 1970's, as part of the early ARPANET development. And I think it's just part of a natural cycle, where industry will embrace a technology when they see the real market potential. And may be reluctant to get into early, no matter how interesting or exciting the technology is, if the market is not developed. So it's not a very predictable thing. But for me,

at the time, as a novice in the area, it was a little surprising.

(OFF MIKE)

QUESTION

BOB KAHN

They were probably too busy building the ARPANET.

(OFF MIKE)

(CUT)

QUESTION

BOB KAHN

Well, I can't imagine any of the ARPANET folks wanting to attend Woodstock. (Laughs) But I suspect, even if they did, they would have been too busy building the ARPANET.

QUESTION

BOB KAHN

Yeah, yeah.

QUESTION

BOB KAHN

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Um, the National Academy just recently finished a survey of the most important technologies developed during the Twentieth Century. And I was somewhat surprised that, uh, on the list, which had a long list of very impressive inventions, like, I think, the jet airplane, and the microprocessor. They did not list networking. Because, I think, in retrospect, uh, networking, the ability of computers to communicate with each other is going to turn out to be one of the lasting contributions of the Twentieth Century. And when ... when history is ... is fully told, many of the other inventions that seem so important now will be succeeded by other kinds of inventions that either do the same job better, or replace it with something else. I think hist ... history will show that networking is here to stay.

(OFF MIKE)

(END OF TAPE)